For the loan of specimens my thanks are due to Mr. Henry Woods, F.R.S., of Cambridge University, and to Dr. F. L. Kitchin and the Director of the Geological Survey.

## EXPLANATION OF PLATE V.

*Scalpellum* (*Cretiscalpellum*) *unguis* (J. de C. Sowerby).

Albian, Gault: Folkestone, Kent.

*Fig.* 1. Part of a capitulum, showing right side, with the valves slightly displaced and the scutum, upper and rostral latus added in outline. B.M., 59802.
*Fig.* 2. Carinal end of a capitulum from right side. Sedgwick Museum, Cambridge.
*Fig.* 3. Associated rostral and inframedian latera (from left side). B.M., 44300.
*Fig.* 4. Rostral and inframedian latera (from left side, found apart on a small piece of clay). *a*, outer view; *b*, inner view. B.M., I. 1573.
*Fig.* 5. Associated rostral and inframedian latera (from left side). Origl. of Darwin's pl. iv. fig. 1 *k*. Geol. Surv. Museum, 31378.
*Fig.* 6. Rostrum. Outer view. Origl. of Darwin's pl. iv. fig. 1 *e*. Geol. Surv. Museum, 31378.
*Fig.* 7. Rostrum. Outer view. B.M., I. 13467.
*Fig.* 8. Rostrum. Inner view. B.M., 41920.
*Fig.* 9. Peduncle plate. Outer view. B.M., 44300.
*Fig.* 10. Peduncle plate. Inner view of basal portion showing median elliptical socket. B.M., 44300.

Figs. 1–8, ×2 diam.; figs. 9 & 10, ×6 diam.

*Scalpellum* (*Cretiscalpellum*) *bronni* (F. A. Roemer).

Middle Neocomian, Hilsconglomerat: Essen-on-the-Ruhr, Westphalia.

*Fig.* 11. Scutum (left). Outer view. B.M., I. 15445.
*Fig.* 12. Tergum (left). Outer view. B.M., 15446.
*Fig.* 13. Carina. Outer view. B.M., I. 15443.
*Fig.* 14. Carina. Inner view. B.M., I. 15444.
*Fig.* 15. Carina. Side view. B.M., I. 15447.
*Fig.* 16. Carina. Side view. B.M., I. 15448.

×2 diam.

For explanation of lettering see legend of text-figure.

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# XLVI.—Deuterophlebia mirabilis, *gen. et sp. n.*, *a remarkable Dipterous Insect from Kashmir*. By F. W. Edwards.

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[Plate VI.]

In October 1921 Mr. Martin E. Mosely presented to the British Museum a few insects collected and sent to him by Mr. F. J. Mitchell, Honorary Director of Trout Culture in Kashmir; the specimens were obtained in the neighbourhood

of Srinagar, Kashmir, in or by mountain streams at a height of 11,000–12,000 ft. The collection contained only about half-a-dozen Diptera, but among these were two examples of the most extraordinary insect to be described below. Many of the characters of this species are so remarkable that there seemed at first room to doubt whether it might not be Neuropterous rather than Dipterous, the wings and head both suggesting the Ephemeridæ in some respects. After an examination of the literature, however, and after consulting my colleagues at the British Museum, and my friends Dr. C. P. Alexander, Mr. J. E. Collin, Mr. K. J. Morton, and Dr. D. Sharp, all possible doubt on the matter has been removed, and there can be no question that the insect represents a new Dipterous type for which it will be necessary to erect a special family. This new family is perhaps allied to the Blepharoceridæ, themselves one of the most aberrant groups of the Diptera, but the differences are so great that there seems no justification for including the new genus within the Blepharoceridæ. Some points of its structure even suggest the possibility that our insect may have some connection, however remote, with the Cyclorrhapha. I propose to name and define the family as follows :—

Fam. **Deuterophlebiidæ**, nov.

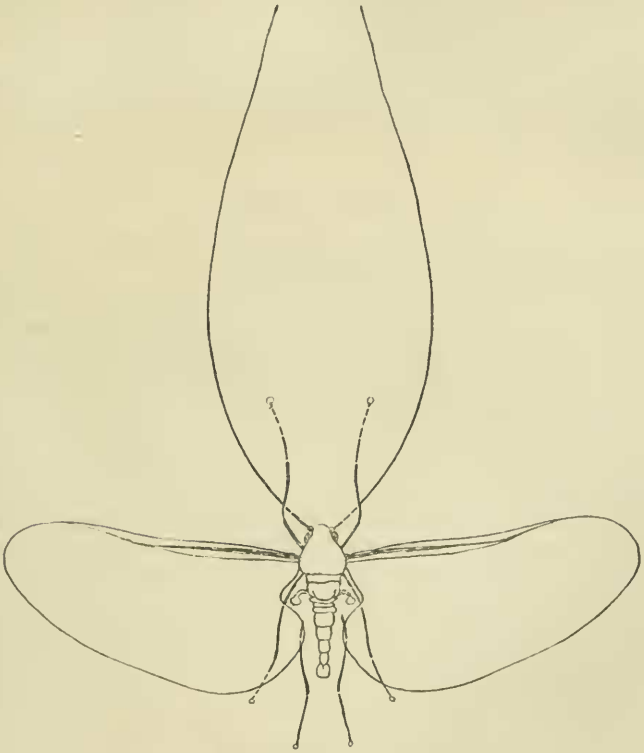
*Head* small, broad, and flat, hidden under the projecting mesonotum. No trace of mouth-parts. No ocelli. Antennæ 6-segmented, the last segment (at least in the ♂) several times longer than the whole body and practically bare, the remaining segments all rather short. *Thorax* very large, not much shorter than the abdomen; no distinct suture between the mesonotal præscutum and scutum. *Abdomen* with nine distinguishable segments (including the genital), but segments 1, 2, and 8 all very much reduced. No abdominal spiracles. *Legs*: coxæ all short. Tibial spurs absent. Tarsi with large subcircular empodia and each with only a single claw. *Wings* very large and broad, covered with dense microtrichia and with a fringe of fine hair round the posterior margin, but no trace of macrotrichia even on the costa. Hardly a trace of true veins, but an elaborate fan-like development of secondary folds, with transverse folds forming concentric lines. Halteres well developed.

Typical genus, *Deuterophlebia*, gen. nov., with the characters of the family.

The new genus differs from all known Blepharoceridæ in the absence of mouth-parts and ocelli, the form of the

antennæ, the possession of large empodia, and the absence of a definite true venation in the wings, of macrotrichia along the costal margin, and of a chitinised area at the base of the anal lobe of the wings. It resembles the Blepharoceridæ in the shape of the body and wings and in the possession of a well-marked "secondary venation"; this last, however,

Fig. 1.



*Deuterophlebia mirabilis*, gen. et sp. n.
Outline of whole insect, × 6. (The writer is indebted to Mr. A. J. E. Terzi for the figure.)

is on an entirely different plan from that known in any Blepharocerid.

As Mr. J. E. Collin has pointed out to me, the antennal structure is curiously suggestive of the Cyclorrhapha, the long terminal segment with two short segments preceding it recalling the arista, with its two small basal segments, of

Cyclorrhaphous families. The reduction of the basal segments of the abdomen might also seem to point in the same direction. However, the structure of the hypopygium is of a distinctly Nematocerous type, and not at all dissimilar to that of the Blepharoceridæ. This organ almost certainly provides the most reliable evidence of relationship. The connection with the Blepharoceridæ may therefore be expected to be confirmed when the larvæ and pupæ are discovered. It may be noted that some rather remarkable unidentified Blepharocerid larvæ from Kashmir have been described by Agharkar (Rec. Ind. Mus. x. 1914).

Unfortunately, nothing was noted by the collector concerning the habits of the flies, and only the male sex was obtained.

*Deuterophlebia mirabilis*, sp. n.

Colour deep dull black ; abdomen less intense than the thorax ; wings greyish, slightly opaque.

*Head.* The head is rather small, and placed so far back under the projecting thorax that only small portions of the eyes are visible in a dorsal view. In shape the head is about one-third broader than long, and very thin and flat, its diameter from front to back being less than that of the rather small eyes. The front of the clypeus has a trilobed appearance, the middle lobe bearing a number of short bristles. The distance between the eyes is about half the breadth of the whole head. The occipital foramen is very large, occupying about two-thirds of the breadth of the head, and there is no distinct neck. The eyes are subspherical, without any trace of division into two parts, or of differentiation in the size of the facets. There is absolutely no trace of ocelli or of mouth-parts, but the mouth is present as a small oval opening on the under side of the head, leading directly into a chitinised internal tube. On each side of the mouth-opening is a small tubular pocket with strongly chitinised walls, near the opening of which is a small bristle. The *antennæ* consist of a two-segmented scape and a four-segmented flagellum ; the first five segments are together not much longer than the breadth of the head, but the remaining segment is fully three times as long as the whole body ; the scapal segments are transversely placed, the base of the flagellum at first continuing in the same direction, and then curving forwards. First scapal segment about twice as long as the second, and somewhat broader, second cup-shaped, somewhat oblique, and about as long as broad.

First flagellar segment cylindrical, about as long as the two scapal segments together, one or two short bristles on the inner or anterior surface near the tip. Second and third flagellar segments cylindrical, together slightly shorter than the first, each with a blunt pale prominence on the inner (anterior) side beyond the middle, the prominences bearing several short pale bristles; there are also a very few short and fine hairs on the dorsal surface. Terminal joint bare except for a few fine hairs near the base, tapering very slightly to just before the tip, which is slightly but distinctly swollen.

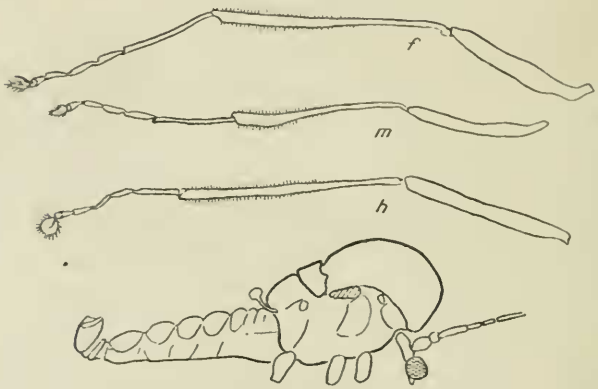
*Thorax* absolutely bare, the integument dull black. Pronotum not traceable. Mesonotum very convex and produced forwards over the head; rounded but rather narrow in front, very broad behind. No definite suture separating the præscutum and scutum, but deep and well-marked divisions between the scutum, scutellum, and post-notum. Area in front of scutellum flat. Scutellum extending to almost the full breadth of the mesonotum, and of even width throughout, its posterior margin slightly rounded. Postnotum large, convex. Owing partly to the intense blackness, it is difficult to make out the divisions of the pleuræ in the whole specimen, and the thorax of the mounted one is damaged. There is a rather large membranous area below and in front of the wing-root. The mesosternum is almost flat. The mounted specimen shows that the prothoracic and metathoracic spiracles are both large, and are each supplied with several tracheal trunks, uniting just inside the spiracular opening.

*Abdomen* broad at the base, and tapering considerably towards the tip, rather feebly chitinised, covered with a fine microscopic pubescence and with a few scattered transparent punctures on the tergites. First two segments very much reduced, without definite tergal plates, but quite distinguishable in the formalin specimen. Third segment as long as the first two together, but still small. Fourth to seventh all rather large, about equal in length, but decreasing in breadth. Eighth reduced to a mere ring, but more strongly chitinised than the preceding. There is absolutely no trace of spiracles in the abdomen—a very unusual condition for an adult insect, as it appears to me. Possibly the spiracles may be represented by groups of two or three minute bristles, which occur in the places where the spiracles would be expected. Tracheæ, reaching back from the thorax, are confined to the basal half of the abdomen. *Hypopygium* of very simple structure, not rotated, turned upwards.

Ninth tergite not distinguishable from the tenth, parallel-sided, with a broad V-shaped apical emargination, which is finely hairy. Side-pieces completely united with the ninth sternite, practically bare, without lobes or modifications of any sort. Claspers simple, rather broad at the base, narrower apically, but with rounded tips; on flexor surface with numerous short curved hairs. Ædœagus a simple, strongly chitinised tube, somewhat broadened at its base.

*Legs* slender, absolutely bare except for a fine, close, erect pubescence on the outer two-thirds of the tibiæ. Coxæ all small, scarcely longer than the trochanters, the hind pair somewhat stouter than the others. Femora nearly cylindrical, all about equal in length, the front pair a little

Fig. 2.




*Deuterophlebia mirabilis*, gen. et sp. n.
Front (*f*), middle (*m*), and hind (*h*) legs, × 30; body in side-view, × 14.

stouter than the others. Front tibiæ about one-half longer than the femora, very slender on the basal two-fifths, then rather slightly and evenly enlarged to nearly twice the diameter. First segment of front tarsi cylindrical, nearly half as long as the tibia, and almost as long as the three following segments together, the last four segments about equal in length. Middle tibiæ one-third longer than the femora, nearly cylindrical, the apical third only considerably enlarged on the flexor surface, extensor surface somewhat concave; tarsal segments bearing the same proportions to the tibia as in the front legs, and therefore shorter than the front tarsi. Hind tibiæ resembling the front ones. First

hind tarsal segment not a quarter as long as the tibia and scarcely as long as the two following segments together. The tibiæ show no trace of apical spurs. The articulations of the tarsal segments are oblique, and there is a rather extensive membrane between most of the segments. The fifth tarsal segment on all the legs is somewhat enlarged apically, and bears a very large, nearly circular, hairy empodium. There is a single rather long and slender, simple, straight, and pointed claw, the second claw being apparently represented by a minute blunt prominence *.

*Wings* extremely large for the size of the insect, very broad, with a conspicuous anal lobe. There are no macrotrichia on any part of the surface, not even on the costal margin, but there is a rather long and delicate fringe round the anal lobe, and the whole membrane is covered with short microtrichia. The costal margin is only slightly thickened, and not any darker than the rest of the wing. There are also very slight thickenings of the membrane faintly indicating some of the veins, the most distinct being *Sc* and $R_1$, the former of these apparently terminating in the latter at about the middle of the length of the wing. More distinct than these vestiges of the true veins is the "secondary venation." This is quite obvious when the wing is in formalin, and on a wing being removed and mounted dry it became so conspicuous as to appear like a true venation. Were it actually so, the insect could hardly be included among the Diptera †. Close examination, however, shows that practically all the lines are produced merely by creases in the wing, there being very little trace of true veins. When a wing is mounted in balsam, the "secondary venation" almost entirely disappears and the traces of true veins referred to above become more apparent. The two photographs given will indicate the arrangement of the vein-vestiges and of the secondary folds. The latter are arranged in a fan-like manner, somewhat suggestive of the hind wing of an earwig. Besides the radiating folds there are three concentric lines across the field of the wing, besides two short transverse lines in the

* It is just possible that the organ regarded as an empodium represents the second claw. Compare the Blepharocerid genus *Hapalothrix*, in which both claws are large and pulvilliform.

† The only insects which have a venation even faintly resembling this are Mayflies of the genus *Cænis* and allied forms, which also, like our insect, have no mouth-parts or hind wings and even a somewhat similarly shaped head. A cursory examination, however, soon shows that these are the only resemblances between the two groups—the Mayflies, for example, having very differently constructed thorax and legs and no halteres.

middle. It is obvious from the arrangement of the folds that the wing is capable of first folding up fanwise, and then doubling up so as to occupy the smallest possible space. In order to demonstrate this completely I made a paper model of the wing, and obtained the expected result by folding it carefully along the lines of the "secondary venation," commencing from the anal angle. Since there is no hard costal margin (as in the earwig) on which the wing can fold back, it is unlikely that the folding actually takes place after emergence; it is much more probable that, as in the Blepharoceridæ, the "secondary venation" merely marks the manner in which the wing was folded in the pupa. This folding of the imaginal wing within the pupal envelope occurs, so far as I am aware, only in the families Blepharoceridæ and Simuliidæ, and almost certainly indicates a relationship between the new genus and one or both of these families. The very regular arrangement of the folds in the new genus is quite unlike the irregular network found in the Blepharoceridæ, in which family, moreover, the folds generally become very faint when the wing is fully expanded and hardened. The basal sclerites of the wing are very peculiar, the attachment being unlike that found in either of the families mentioned.

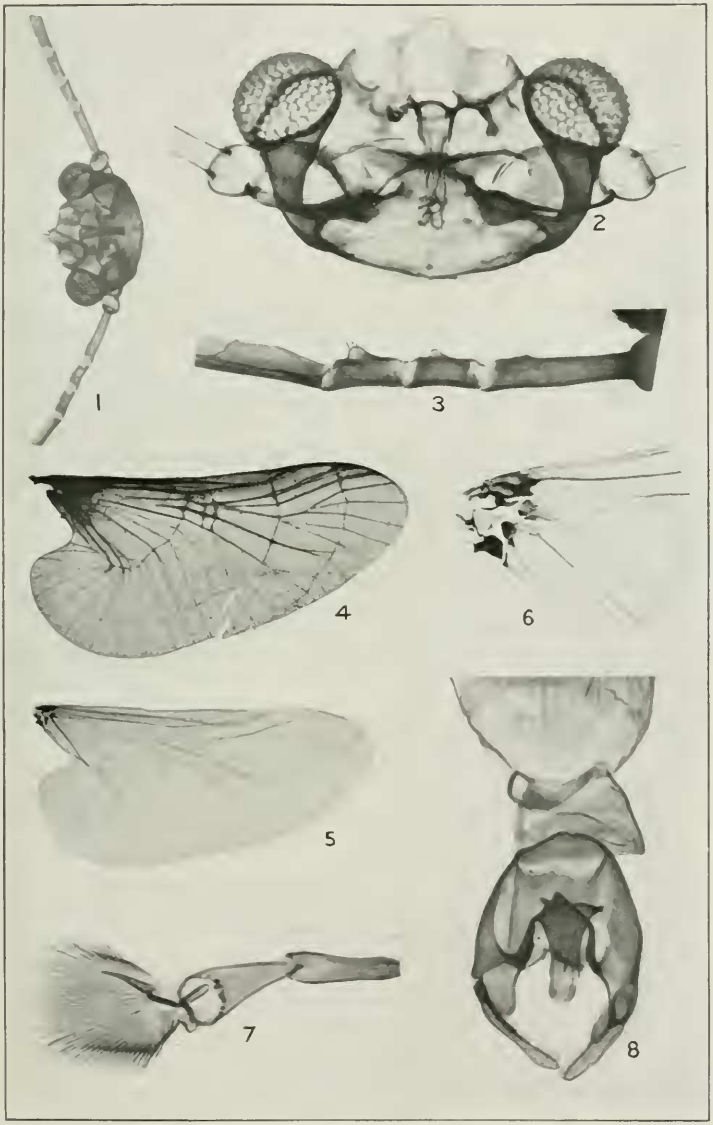
*Halteres* with rather slender curved stem and almost globular knob, surface covered with a microscopic pubescence.

*Measurements.*—The following are taken from the formalin specimen, the mounted one is rather smaller:—Antenna, 13 mm. Thorax and abdomen, combined length, 3·7 mm. Width of thorax, 1 mm. Length of wing, 5·6 mm. Greatest breadth of wing, 2·9 mm.

The following are taken from the mounted specimen:—

| | *Femur.* | *Tibia.* | *Tarsus.* |
|---|---|---|---|
| Front leg ..... | 0·75 mm. | 1·1 mm. | 1·0 mm. |
| Mid leg ..... | 0·66 „ | 0·81 „ | 0·82 „ |
| Hind leg ..... | 0·81 „ | 1·0 „ | 0·66 „ |

*Hab.* Kashmir: Srinagar, 11,000–12,000 ft., July or early August (*F. J. Mitchell*). Cotypes, two males in the British Museum, presented by Mr. M. E. Mosely, Oct. 1921—one dissected and mounted in balsam, the other in formalin, one wing removed and mounted dry. Mr. Mitchell unfortunately kept no notes as to the habits of the flies, but wrote on 25.xi.1921 that "the area in which the collection was made is now probably under 6 ft. of snow, increasing possibly to 20 ft. or 30 ft. in the spring."




*F. W. Edwards, photo.*

DEUTEROPHLEBIA MIRABILIS.